Accepted Manuscript

Slope stability and exact solutions for cohesive critical Coulomb wedges from Mohr diagrams

Florian K. Lehner, Martin P.J. Schöpfer

PII: S0191-8141(17)30318-8

DOI: 10.1016/j.jsg.2018.04.021

Reference: SG 3646

To appear in: *Journal of Structural Geology*

Received Date: 22 December 2017

Revised Date: 25 April 2018

Accepted Date: 27 April 2018

Please cite this article as: Lehner, F.K., Schöpfer, M.P.J., Slope stability and exact solutions for cohesive critical Coulomb wedges from Mohr diagrams, *Journal of Structural Geology* (2018), doi: 10.1016/j.jsg.2018.04.021.

Slope stability and exact solutions for cohesive critical Coulomb wedges from Mohr diagrams

Abstract

This paper deals with questions of the stability and structural characteristics of submarine sedimentary slopes and accreting wedges and with a theoretical treatment, based on the assumption of a Rankine limit equilibrium state of (effective) stress in a rigid-plastic Coulomb material. For plane states of stress in uniformly sloping layers, this allows one to extract stability criteria in terms of generalized earth pressure coefficients, as well as exact cohesive critical taper solutions directly from a Mohr diagram. While an approximate solution of Dahlen et al. (1984), for small taper angles, demands an upward convex surface, cohesive Rankine state solutions require curved detachments, in agreement with curved slip lines, in the shallower part of a cohesive Coulomb-plastic slope. It is further reiterated that in such materials water loading will not affect the stability of normally pressured slopes and that solutions for subaerial (dry) and submarine (normally pressured) non-cohesive critical tapers are identical, with obvious implications for scaled physical (sand box) model experiments.

Keywords: Rankine states, Mohr diagram, slope stability, plane of weakness, critical taper

1. Introduction

A classical problem of soil mechanics is that of finding the earth pressure on retaining walls. Here a well-known solution, given by Rankine (1857), continues to